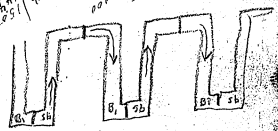
Notebook, N-87-03-01

This notebook covers the periods March 1887 and March 1901. All entries are by Edison. The first entry is undated and relates to battery experiments. It is followed by a set of notes and a drawing from 1887 pertaining to the development of an economical prime motor (probably his magnocaloric motor). In the course of making these notes, Edison recorded a discovery regarding magnetized iron. Following these entries are additional notes about battery experiments. The next dated entry is from March 1901 and concerns Edison's theoretical speculations on electricity and magnetism. There are also a series of hypotheses and some notes about thermoelectricity. The remainder of the book consists of miscellaneous notes, drawings, and calculations about thermoelectricity and batteries and some drawings that appear to be plans for an ore milling plant. The book contains 284 numbered pages.

Blank pages not filmed: 48-75, 78-97, 114-135, 168-175, 182-259, 266, 269-271, 276-277, 280-281.

Missing page numbers: 267-268.

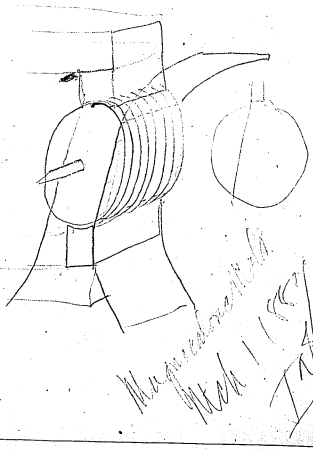
Bi pt etc Pos E goes from the Cold piece I
to hot piece
at in neg metals Zn Fe Sb from
from hot to Cold

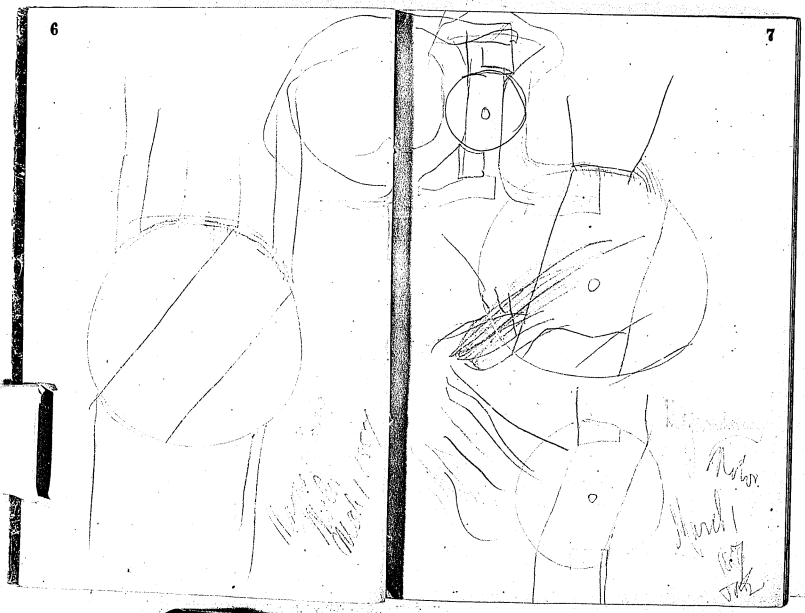


No 40987
ARTHUR & HOWELL
MANUFACTURERS
55 CEDAR STREET
New York

The object of this invention is to produce a simple & economical prime motor

The invention consists in producing a dysymmetric magnetic distribution of the lines of force in a magnetic circuit, by means of heat acting ~~The disturbance~~ on the magnetic substance. The disturbance taking place in the movable part of the magnetic circuit, so that





Continuous rotation takes place as long as heat is applied to the moveable magnetic part of the magnetic circuit

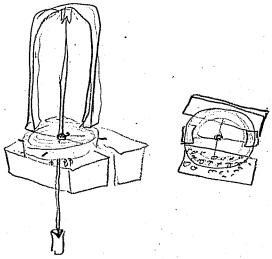
~~I have discovered that~~ when Iron is powerfully magnetized ~~that~~ say near its saturation point, that ~~a proportionally~~ of ~~heat produces powerful changes in the magnetic~~

It is well known that the magnetism of Iron & other paramagnetic bodies is diminished by heat

I have discovered that when the iron is powerfully magnetized say nearly to saturation that its magnetism is extremely sensitive to heat, a slight increase of temperature produces a powerful diminution of magnetism, so that a great portion of the energy of the heat is transformed into actual motion for various uses. I have constructed an simple apparatus by which

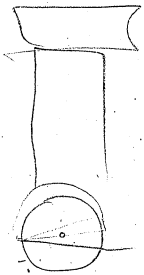
~~Illustrates this phenomenon~~

illustrates the method by which this phenomenon is utilized



In the primitive motor the
[illegible] of one or more
magnetic circuits of which
[illegible] parts are movable
[illegible] of [illegible] one or
[illegible] of [illegible] to produce motion

In a magnetic circuit of
which one part is
movable. The disturbance
of the magnetic [illegible]
[illegible] of force by the out
to produce motion



Conductivity fused salts Braun
Pogg Ann (Cliv 161) Conductivity
in vicinity of melting points
if Hg at 0° cent is 100 000 000
& best H_2SO_4 solution 7.700 —

then	$PbCl_2$	32 200
	$NaNO_3$	11 475
	$AgNO_3$	8688
	$NaCl$	8660
	KNO_3	6900
	Na_2SO_4	3680
	$SrCl_2$	2260
	K_2CO_3	2150
	$ZnCl_2$	85 — ? ?

Solid Zn 600 times greater R than Silver —

Reg with Solutions hence generally at lower res except — Case $ZnCl_2$ which is extraordinary low —

Cryolite melts below red heat

Teloxide containing melts below red heat,

Positive Ions

$H^{\cdot}$ Na K Ag $Hg_{\cdot}$ Hg'' Fe'' Fe''' NH_4 NH_3 CH_3 etc

Neg Ions OH NO_3 Cl Br I SO_4'' $FeCy_6'''$ $FeCy_6''''$ etc –

March 12 1901

Theory

1 The combination of an atom or molecule of Oxygen with a molecule of Zinc in a battery has the effect of a general expansion of matter. This increase in bulk sends a wave through the wire — The wave is like a sound wave as regards the wire + a wave in the Ether at right angles to the wire — all Combustables, or matter not reached its zero potential is condensed into the ether —

2 The cohesion of the wave energy is lost in expanding matter by the absorption of heat + performing work of expansion — Remember what is the effect of the absorption by matter in the act so to speak

3 The wire is a good or bad conductor according to the elasticity of the parts or the viscosity of the distance apart of the Molecules — The further they are apart the worse the Conductor

4 Any translating device inserted in the Circuit is merely an agent to transfer the waves into heat at other points

5 The amplitude of the wave or Em f depends upon the Energy of Combination of the Combustable which Ox. of slo

The waves which are greater amplitude from O & Mg than from O & Cu — as the expansion is greater able products —

6 Putting 2 cells in series doubles the amplitude of the waves, if the R is the same doubling the amplitude doubles the Current + quadruples the heat, ~~[illegible]~~ The number of vibrations is the same as with one cell — the extra energy goes into increasing amplitude

7 If the resistance is doubled there will be the same number of vibrations, their amplitude will be half the Current will be half and the heat will be 4 times less than in the single Current R — total heat twice

8 The waves passing over the wire proceed like sound waves. These waves send a wave into the Ether at right angles to the wire.

9 A Coil of wire concentrates a large number of waves on a small area. They form together large compound wave in the ether

10 A Magnetic Metal within a Coil the large wave is sent into the wire. The new waves, send contrary waves into the wire diminishing the height of the primal waves to do this the nonmost heat rightly la

11 The Capacity of the from to send back waves quickly diminishes, as its molecules become arranged against their normal Condition in Connection with the Ether =

12 The magnetic metals are magnetic because their molecules have little Elasticity were they as elastic as Copper they would not be magnetic or they are connected to the Ether in a manner different from the non magnetic metals

13 When magnetized their molecules are condensed like Zn in its relation to Ox acts to the Ether when demagnetized Expansion takes place & work will be performed.

14 If surrounded by a closed wire the work will be performed in the wire, if no wire the work will be performed in the magnet it will be heated —

15 = The wave in the wire & the wave through the magnet is the same. The reason that the mag is placed at right angles is that the wave in the wire proceeds like a sound wave this make a wave in the Ether at right angles & this striking the iron is reproduced into a wave travelling in the iron like that in the wire what we call magnetism

to compute ~~as~~ recorded or fixed electric waves not moving — to like Tourmaline —

16 = The further the Copper molecules are apart the greater the local heat from the passage of the waves, if the molecules were in actual Contact & all infinitely Elastic the waves would have no resistance & the whole of the Expansion Energy of Battery Combustion would take place on the ZnSO. Nitrate & be pure — yet the Current would traverse the wire —

17 All Electrolytes dissolving in water, combine with it with great power but instead of giving off heat the energy is stored in the form of electric charge. After the Electrolyte has combined with water it requires a large amount of energy to separate the two such as evaporation etc, as the boiling point is raised for instance of boiling point ~~boiling~~ of a pound of water is raised 1 deg then the Energy of Combination of the Electrolyte will be represented by the Extra energy of 1 deg in evaporating the whole of the water by distillation so as to

K_2O SO_4

KOH

KOH

put the 2 compounds back into their original position — Change of temp of water is due to, Combustion solution of a solid — a liquid.

18 = adding a Combustable to water will not make it Conduct, adding a Combustion like O Cl 3 to water will also not make it Conduct but adding the products of a Combustion like KCl Will make it Conduct —

19 — a liquid with 2 Combustables ~~will not~~ like a hydrocarbon will not act as a Electrolytic Liquid —

Id = a liquid Chloride of a metal with the oxide of a metal if one could be found that will dissolve should give an Electrolytic Combination but not if there is a great Excess of Chlorine in the Chloride -

21 This rule ought to hold with anhydrous fused Substances

22 – There is no Pos Elec passing in one direction & negative Elec passing in the opposite direction, this would be absurd – just as a Sound wave rarefaction would be positive Sound & condensation of barometric pressure the negative Sound –

22 = Electricity must be of one
Kind simply a wave in matter
Connected to the Ether,
That part of the wave which
produces Condensation of matter
produces certain effects
while that part which produces
Expansion produces other
Effects - chemically + otherwise

Oxy Combining with Zn produces
either Condensation or O being freed
from say CuO in a battery
Expansion —

23 — a magnet or a piece of
Electrified sealing wax
is simply a recorded wave.
one end. Condensing the other
Expanding. The two naturally
tend to fall to Zero

24= If in a conducting circuit one part be rarefied & the other condensed a current will flow – (10) Thermo piles – or cells

25= Zinc is produced from the oxide by ~~a forced~~ a forced decomposition (reduction) by heat, hence in a battery, it is the equivalent of the ~~Cold~~ heat of junction (Cu) is produced by a (cold) combination ~~heat~~ hence etc the equiv of the ~~Cold~~ junction – The greatest forced decomposition & combination, gives the greatest Emf –

26 =

Hence the best thermo would be a junction which one metals has a heat conductivity diminishing with the temp & the other increasing with the temperat

27 or one metal increasing or decreasing faster than the other,

28= Or two metals which when reaching a certain temp one would require a greater constant supply of heat to hold it in its strained condition than the other —

29 - Condensation in matter produces heat, Expansion absorbs heat for instance Bend hard rubber one side hot, Compressed, the other side cold, Expanded.

1000 times worse Cop
1" fuse 1/32 thick 1/20000 ohm
20 in series 20/20000 ohm or
1/1000 ohm, 1 Volt 1000 amp
15/15 – 100 Volt amp
15/10000 20/20000 (1000
2a

2500 Volt amp – 15 MP

1000 times worse cop

1/2000 – ohm 1 ft

1/2 ohm ft 4"

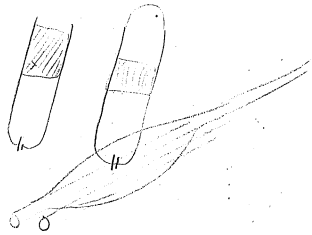
12/500 (41 .041 1" long
48
2 0015 – 1/32
60

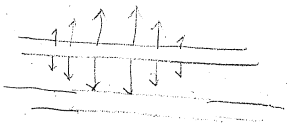
Notes to be entered in other book –

Spring mixed Potassium Nitrate & Sodium Acetate, solid but powdered, + saturated Urea to Jump 100 Cent, both salts fused with one mass although Knit & Macalaster fuse about 330 Cent –

This shows possibility of "alloys" of lower MP for solid Salts, in Re Coal direct & dry battery delands –

Write Johnson Matthey & Co Hatton Gard London for catalogue of Metal Chemicals etc price





All diaelectric let stors work on closing a wave of it passes into them it causes.

All paramag let stors work on closing ~~[illegible]~~ a wave passes into them or their sises to fade

Hypothesis

No 1 = Most powerful thermo is when one metal or substance diminishes its Conductivity by heat while the other increases its Conductivity by heat — ~~or increases~~ C. Sc Jo. S. Condon Fa Exception, 56 55

No 2 = The best 2 metals are those one of which has the greatest specific heat + the other the least (atomic or Equal bulk or Equal wt 5)

No 3 One where one metal has the highest Conducting power or does not conduct for heat 1 + the other the least

4 The metal or Compound which has the greatest expansion by heat & the one with the least,

5: The Metal or Compound which is nearest to melting point & the one furthest from it

6th The Compound which has its heat Conducting increased by heat & nearest to melting point with a metal has has its Conducting decreased by heat & is furthest from its melting point –

7 = That compound whose Crystalline form or allotropic Condition tends to change the most by heat with that metal or Compound which tends to change the least.

8 Iron is the opp of Bi - but at red heat it changes to Chromoclase & goes on Bi side now. The change from Bi " to Fe side takes place when Fe has diminished Capacity for heat, hence No 2 Hypothesis

9 = If Specific heat is proper Hypo then 2 Compounds out of which has the greatest spec heat per cube square inch + the other the least

P

11 = Fe gets plastic
Zn " " where the can be rolled
Carbon gets plastic in filament
Does arsenic + Sb —

Neg

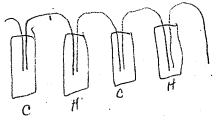
Selenium gets crystalline at high temp
Sulphur " " "
Does Bi + Te

10, The compound which has the greatest spec. heat per oz + the other the least

10 The Compound which has the greatest specific heat per gram molecule the other the least,

11 - The Compound which by heat gets more plastic or viscous with one that gets more brittle or less viscous - independent of annealing action —

Wednesday ~~the~~ planet
Thursday Lunar
Friday planet
Sat Lunar



modified

12 – from metals or Compounds
Crystalizing in the Cubic system
with Compounds Crystallizing opposite
or amorphous —

13 Compounds which crystallize
in one form which heat or
Cooling by heat to
Change to the other form
+ metals which act in
the reverse direction.

14 = Compounds whose Crystals
act like Tourmaline but
are Conducting + have a certain
form of Crystal which directs
the Current with analogous
Compounds with Crystals
which direct C — opposite
direction —

good

15. Iron Ni & Co will act different because their molecules are arranged different in relation to the Ether of space than other Compounds –

16 = Compounds which are at normal temp. arranged with the Ether in one way & Compounds at same temp which are arranged with the Ether in the opposite way

17 Magnetic Metals will act different because their Crystals are peculiar & different from all other substances in relation to waves like E

Also by fusing Copper Nitrate & KOH at red heat

Note — Is paracyanogen a Conductor well it act as a thermo Element

Mendeleeff p 405 2nd vol foot note says Cupric hydroxide acted on by Potassic Hypochlorite gives a peroxide of Copper CuO_3 which combines with the K very slightly heating the Salt slightly formed choony at + CuO_2 S.S is precip — Make Iodide

Thought for a good Idea
to act on Iron Cu Sb
Tin, Etc with Hypochlorite
see what can get off
Jelunde —

p

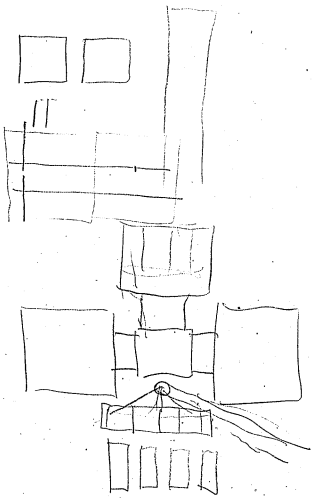
Cu Hat

Hcl x
HCy x
Boric x
Orthophos x
Cupric Chl weak
CoCl
Manganous Chl
Chromic acid
chromic Chl
Zn Sul weak Sol
Mg Sul
Cu Cl
Sr Nit
Sr Chl
Ba Chloride
Na Nit strong
Na Cl
Na I
Carb Na
Deborate Na

Na Sul strong
Disodic Phos
K Nit
Nitrate K
Chlorate K
K Bromide strong
Ca I strong
K Carb
Hydro Carb K
Bichrom K
NH_3
NH_3 Chl
KCy
Ferro
Zn ac
Na act

Neg - Cold Cop -

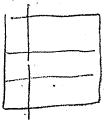
Nitric Acid
Chloric Acid
Hydrobromic Acid
Hydrofluosilicic
Sulphuric Acid Ox
Ferrous Sul
Cupric Chl strong Ox
Cu Sul
Zn Sul strong
Na Nitrate
Na Iodide weak
K Iodate Ox
Chrom alum
Ammon Nit
Oxalic Ox
Acetic Ox
Tartaric Ox
Citric Ox



3 1111

48
2
96
12
192
96
115 500 (2.22
1728 / 57600
5184
5760
5184
576

2
3 / 250
83

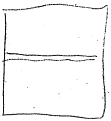


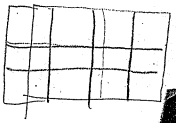
/500

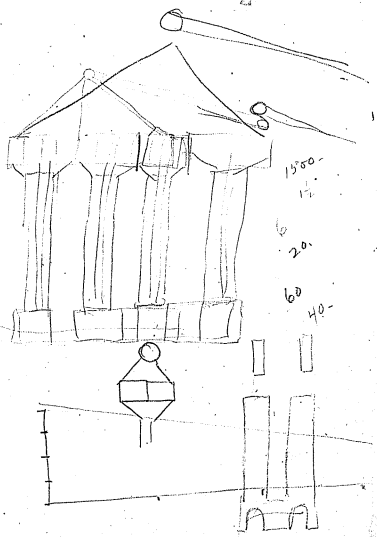
500

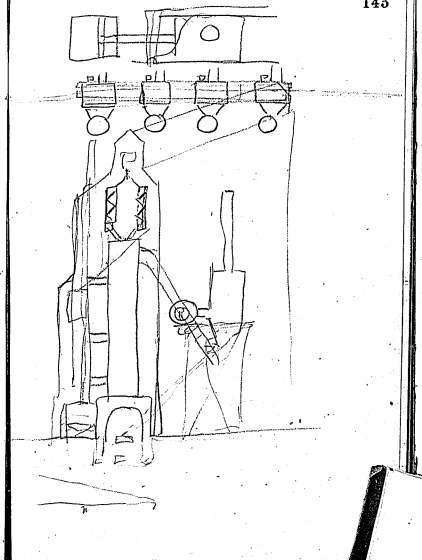
1152

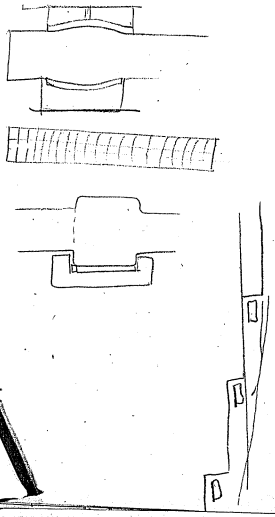
500
6 / 2000
2240 / 33360 (14.8
22400
10960
8960
19900

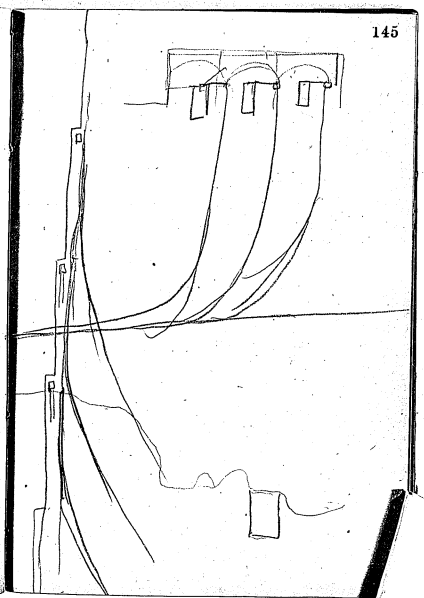


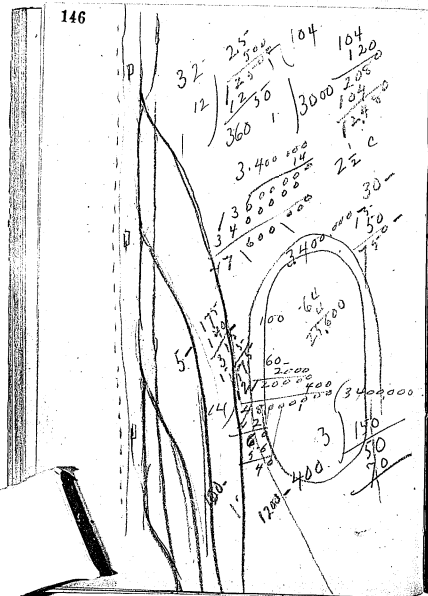


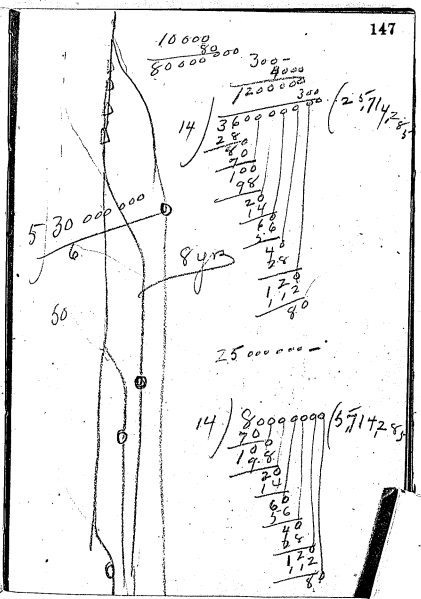

1500-
20.
60
40-











Const

X =
= X

SO_3 Na
H — O

$H_2O.SO_3$
O. H_2

H_2 SO_3.O
H_2

H O
N SO_2

H — O
SO_3 — Na

SO_3 H_2 O
SO_3 Na

CH_2 OH
Cl — Hg

Na Cl
H Cl.

K. Cy
O — H

C_6H_6 — OH.

/ Zn Cl
Je H

C_2Cl_2
Cl — Na

C O.
O. Na.

SO_3 K
Br — Cl

nSO_3 K p
pNa — SO_3 n

Antimony with Zinc
1 part of Zinc w 1 2 3 4
+ up to 100. parts of antimony
This will give a series of alloys
starting with 1/2 Zinc + 1/2
antimony + increasing in
antimony until the last
alloy is 1 of Zinc + 99 of
Antimony

2nd — start with 1 part of
Antimony + one part of Zinc
+ then 1 of antimony with
2 3 4 5 + up to 99
parts of Zinc.
This will give every possible
alloy of Zinc + Antimony
200 of them —

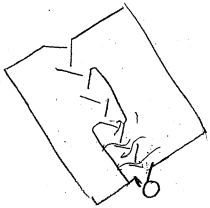
Bismuth + Antimony - same
number of alloys 200 as with
Zinc + Antimony —

Bismuth + Zinc 200 alloys

Bismuth + Cadmium 200

Antimony - ~~Zinc~~ + Cadmium 200

Zinc + Sulphide of Lead 200
Antimony + Sulphide Lead 200
Bismuth + " " 200
Cadmium + " " 200
Zinc + Sulphide of Copper 200
Antimony + Sulphide of Copper 200
Bismuth + " " 200
Cadmium + " " 200



Zinc + Tin
Antimony + Tin
Cadmium + Tin
Bismuth + Tin

Tellurium + Antimony
Tellurium + Bismuth
Tellurium + Zinc
Tellurium + Cadmium
Tellurium + Lead
" + Tin
Selenium + Antimony
" + Bismuth
" + Zinc
" + Cadmium
" + Lead
" Tin

Zinc + Phosphide of Copper
Antimony + "
Cadmium + "
Bismuth + "
Tin

Zinc + Phosphide of Lead
Antimony + "
Cadmium + "
Bismuth + "
Tin

Same with Phosphide of Iron

Zinc + Phosphide of Iron
Antimony + "
Cadmium + "
Bismuth + "
Tin

Zinc + Monosulphide Iron

Antimony + "

Bismuth + "

Cadmium + "

Tin +

Lead +

Zinc + Monosulphide Nickel

Antimony + "

Bismuth + "

Cadmium + "

Tin +

Lead +

Zinc + Sulphide of Antimony

Antimony + "

Bismuth + "

Cadmium + "

Tin + "

Lead + "

Zinc
Lead
Tin
antimony
Bismuth
Cadmium
} and Arsenide of Nickel

Zinc
Lead
Tin
antimony
Bismuth
Cadmium
} & Arsenide of Lead

Zinc
Lead
Tin
Antimony
Bismuth
Cadmium
} & arsenide of Iron

Zinc
Lead
Tin
Bismuth
Cadmium
Antimony
} and Arsenide of Antimony

Zinc
Lead
Tin
Bismuth
Cadmium
Antimony
} Arsenide of Bismuth

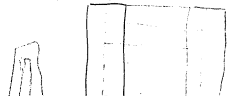
Zinc
Tin
Lead
Bismuth
Antimony
Cadmium
} + Arsenide of Copper

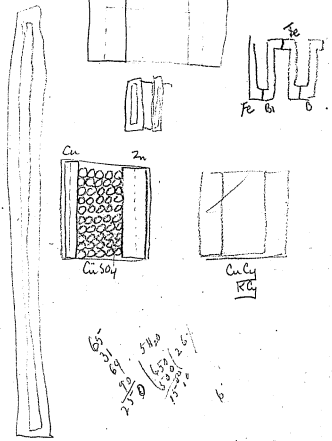
Powdered Tourmaline –
Oxalate of Calcium –
Lead salt of Hydroxalicylic Acid
Watts H – 219 – Electric
by friction –
Tungsten Bronzes –
Selenide of Iron Hard
& brittle Metallic like

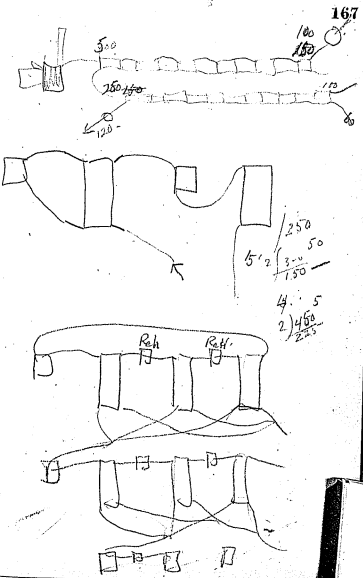
Leucophane Electric
by heat "H" watts 584 —

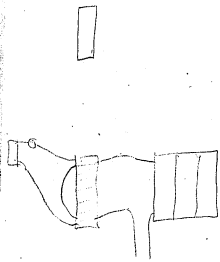
Di-Cupric phosphide
Conductor — 2nd val Watts
73

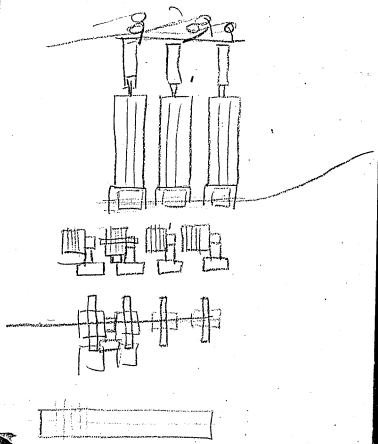
Niobium Nitride Conducts
Electricity —



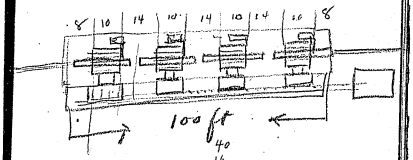

Fe
Fe
Cu
Zn
CuSO4
CuCl
KCl


500
100
150
250
150
120
250
50
150
4.5
450



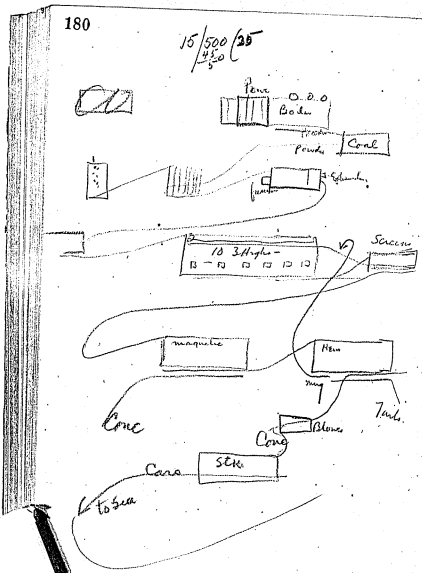


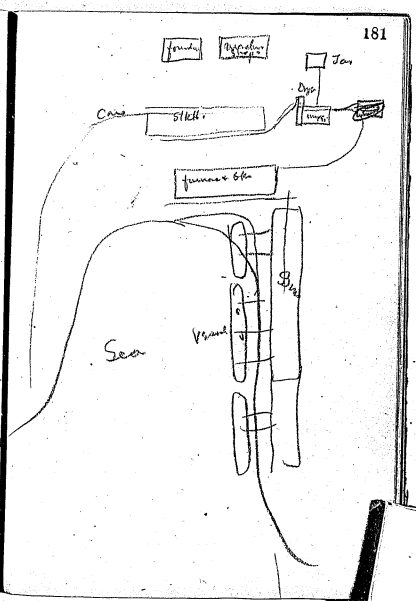
Dryers —

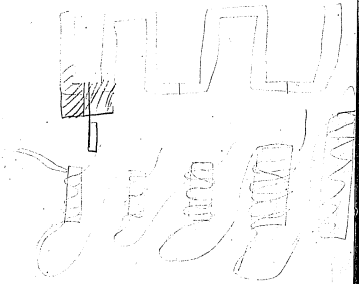


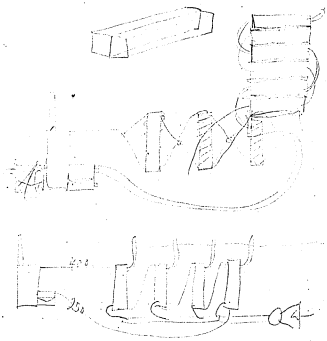
40
16
42
98 -

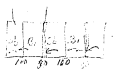
100

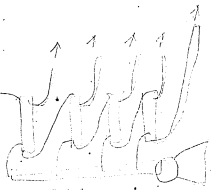

Coal
Screen
magnetic
Cone
Cone
Cone
To Sea

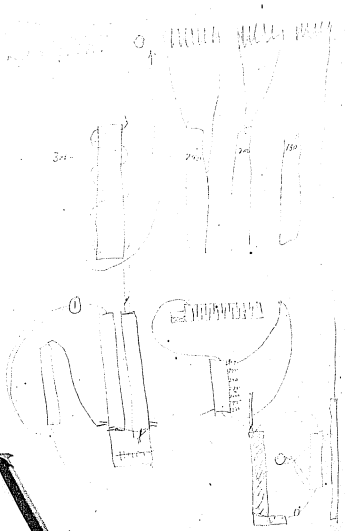

Jar
Cone
Sea
Vessel

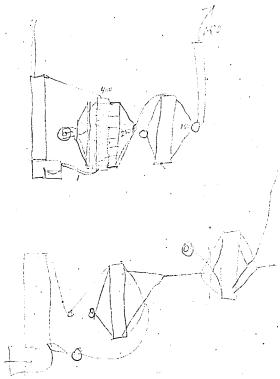



400
250
400
250


70
90
160


250
150





Cu — KPb — H_2O

Fe — All metals but Hg Ag Au [illegible] to a certain degree: Pb [illegible] Hydrofluric and cleanup Hydrofluric and

Solid Fluoride PbF_4
Corresponding to PbO_2

MnO_2 — K^+O

Fe — Lowest mass stable form is Bifluoride Lead $PbHF_2$
Compounds to PbO — non metals dont, Te, S, Se S.S

$MnCl_2$ — KCl

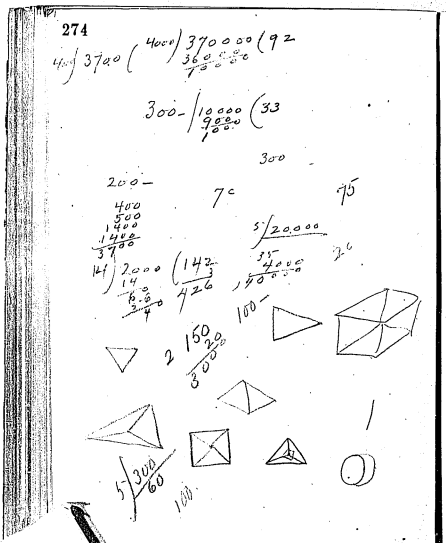
Fe — Cl

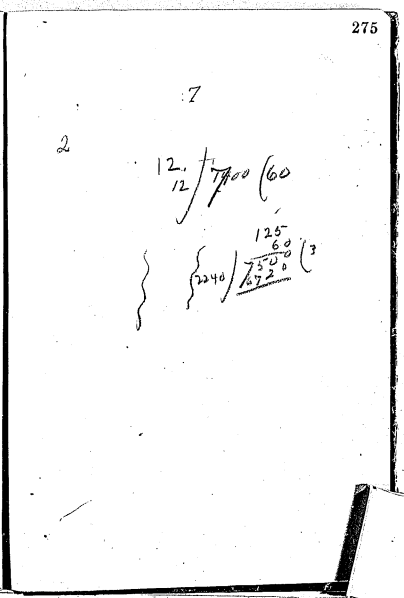
$PbOH$ — $SbOK$

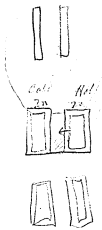
Pb

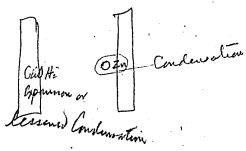
Hydrofluoric acid forms acid salts
Thus we have — HKF_2

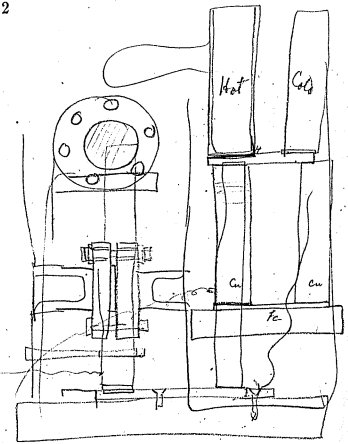
If a metal (e.g.) no
resistance to the rotation of
revolution of the [illegible]
is no nothing. There would
be no current flow, no
there would be no ay
to transfer. The fluorine would
due to combustion —
in other words at absolute zero
No combin power [illegible] —

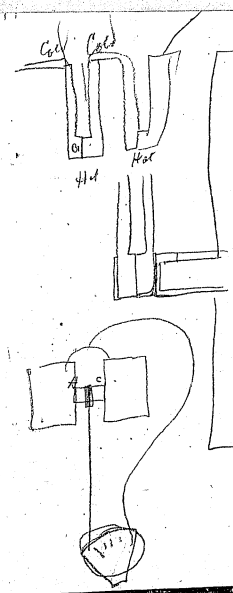


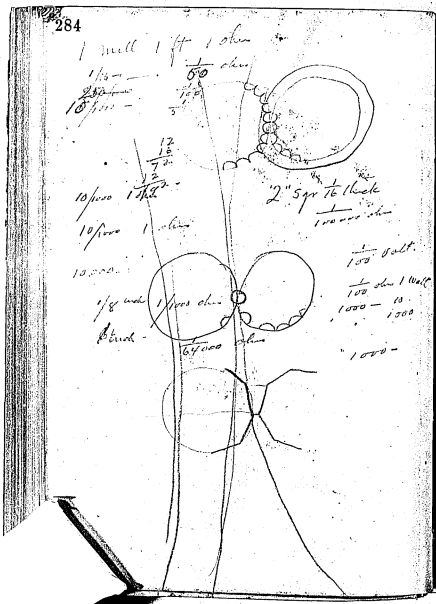


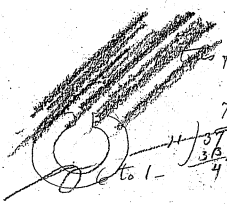

Cold
2in
Hot
2in


Cold Hi
Optimum or
Reversed Condensation
0.2in
Condensation


Hot
Cold
Cu
Cu
Fe


Cold
Cold
Oil
Hot
Hot
A
C





$$\begin{array}{r} 75 \\ 5 \\ \hline 375 \\ 35 \\ \hline 4 \end{array} \quad 34c$$

12 to 1

180 lbs

$$180 \overline{)2000} \quad 11.$$

13000 lbs Hg

$$\begin{array}{r} 50 \\ \hline 10400 \end{array}$$